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Innovation development needs in manufacturing companies

Adriana Tiron Tudor, Monica Zaharie*, Codruta Osoian

Babes-Bolyai University, Faculty of Economics and Business Administration, Cluj Napoca, Romania

Abstract

The manufacturing sector in Romania has undergone great challenges during the last decades. The globalization process has lead to a severe decrease in the demand for the Romanian manufacturing sector. Thus, in particular the small enterprises need to focus on identifying innovative solutions for surviving the competition. The present paper aims to explore the innovation development needs of Romanian manufacturing companies. Bearing in mind the findings brought by the analyses performed on technology focused manufacturing companies, the paper sheds light on the development needs expressed by Romanian manufacturing companies with regard innovation. The research methodology is based on a quantitative survey applied on small manufacturing companies. The questionnaire was developed based on the literature review and on qualitative interviews conducted with owners of small companies. The research instrument was applied on 30 small and medium size companies in the Cluj county. The survey measured the development needs of the companies with respect products or services, information and communication technologies, technology issues, leadership, organization structure, work process, employees' skills, work conditions, team work, cooperation with other companies, and wage system. Next, the research instrument explored the companies' perceived development needs in order to foster innovation. When finding new ideas for developing the workplace, the most frequently used methods reside in using the internet (85%), followed by customers (83%). Study results and scientific publications, universities, research institutes, or other authorities are less often valued by the surveyed companies. The paper identifies some of the main information sources used by companies in order to innovate. The results show that the companies value less the scientific oriented sources, which might be a cause for the low innovation outcomes. The paper brings light on the relationship between education and technological innovation practices implemented in small and medium manufacturing companies.

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* Corresponding author. Tel.: +40 745 436 800;
E-mail address: monica.zaharie@ubbcluj.ro

1. Introduction to innovation: conceptual elements, approaches and differences

The innovation process is vital for the manufacturing business, and as Barden (2008) notices, companies cannot afford to perceive innovation as an optional extra. Although the importance of innovation is widely recognized, there is no unanimously accepted definition on what innovation means. Comparing the numerous definitions, Goffin and Mitchell (2010) notice that they cover a set of common elements:

- *what* is changed (products, services, business process, and manufacturing process);
- the *degree* of change (a completely new output or some modifications were implemented to a previous version of the product. With this regard, there are radical innovations, which represent completely changes compared to the existing ones and incremental innovations, which represent small changes to existing products. While the importance of the latter might be diminished, the research at INSEAD business school in France conducted on 100 companies shows that 84% of the innovations were incremental and that they generated 62% of the revenues);
- the *source* of change (which might be technology, market demand etc);
- the *influence* of the change (its value).

The present study will define innovation as the use of new technological and market knowledge, business models which have the potential of developing new products or services for customers who purchase them, generating profits (Afuah, 2003, Warren, Susman, 2002). Nevertheless, even though the importance of innovation is so widely recognized, the literature findings show a gap between the new ideas phase and the implementation of innovation practices (Brousell, 2008). The survey conducted on 300 manufacturing organizations in USA and 170 European shows rather similar results in the two areas. While over 50% of the companies report innovation efforts driven by insights about customer needs, less than 30% admit to have put in place a core set of metrics to measure the innovation efforts. Moreover, over 40% of the organizations are not sure that such metrics exist within the company. Similarly, the survey shows that almost 60% of respondents agree that innovation has been identified as a strategic initiative, but only around 42% admit having a clear vision for innovation throughout their organization. The same situation was found with regard the gap between having an innovation strategy and having mechanisms and management established responsibilities which to lead to achieving it. Also, only about one third of the respondents declare to have a systematic method to keep track of the innovative ideas. The achieving the sustainability of innovation the companies need to allocate resources and invest in trainings. Although 40,6% of the European companies and 30,9% of the USA ones declare to implement trainings, these efforts still need to be continued.

The value of the innovation process is also argued for the export activity. Lee's (2011) analysis on three innovation surveys conducted in Malaysia during the period 1997-2004 identifies innovation (both product and process innovation) as a key driver in exporting. The study argue for policy makers to focus on increasing the innovation capacity so that to support the export dynamics. Aw, Roberts and Winston (2007) show that companies in Taiwan which implement R&D, offer trainings for their employees and have export activity also have a larger productivity compared to companies which only export. Another hypothesis in FDA states that manufacturing innovation can boost research and development (Wechsler, 2004).

Literature studies explore the relation between productivity, innovation and research. Based on econometric models Crepon, Duguet, and Mairesse (1998) show that the company innovation results (number of patents and innovative sales) increase with the research effort and with the demand pull and technology indicators. Also, firm productivity positively correlates with increased innovation output. The structural model applied by Griffith, Huergo, Mairesse, and Peters (2006) on data from four countries shows that the innovation output is strongly influenced by the innovation effort in all the countries analyzed, while the impact of innovation on productivity was identified only for three of the countries (France, Spain and UK), but not for Germany.

Literature findings show differences between service and manufacturing companies with regard innovation practices used (Ettlie, Rosenthal, 2011). The firms in manufacturing sector are more likely to report the need for new strategies and structures when dealing with new products. On the other hand, companies in the service sector are more frequently develop novelty into success, implement beta testing phases, and value the management ideas (internal source) in cases of new offerings. No matter the differences, the results of the survey conducted on 67 companies (Ettlie, Rosenthal, 2011) show that both types of organizations value the customer feedback (external source) when dealing with new offerings. Oke's (2007) study, based on qualitative interviews and a quantitative survey applied on 214 service companies in UK, shows that firms in telecommunications and financial sectors are

more focused on product innovation, while firms in transport and retail sectors are more oriented on service innovation. Radical innovation and incremental innovations were identified to be related to innovation performance and to innovation management practices.

2. Innovation models and success factors

The innovation models can be grouped as being static (focused on company behaviors at a specific moment in time) or dynamic (focused on the innovating features and their change in time). The present paper survey is interested in the first type, trying to explore the innovation development needs at a specific moment in time.

While there is no one single solution for the innovation dilemma, companies have to acknowledge the need to develop an innovative environment. Barden (2008) identifies a set of basics for the success of the innovation process: *cost* (managing to convince the employees that there is a real need to reduce costs and eliminate the non added value means generating innovation); *quality* (the focus on quality is a drive for inspiring employees to be innovative. There is an intrinsic relationship between cost, quality and innovation); *productivity* (in order to reach innovation the company needs a constant and systematic interest in increasing the productivity); *relevance* (the management needs to be aware of what is relevant for the business within the market so to be able to value all the potential sources); *market awareness* (in strong connection with the relevance element, companies need to identify the gaps in the market and explore all opportunities); *competition* (any business and its employees have to constantly be aware that it has to be better and more innovative than the competition is); *discipline* (the success is strongly dependent on companies being disciplined, manage to time pace and set development goals). Moreover, Barden (2008) highlights the importance of professional management for a company to be able to generate innovation, based on qualification and taught management skills.

The Cisco innovation model (CISCO White Paper Manufacturing Innovation) based on internal experience and customer outcomes includes five dimensions critical for innovation in manufacturing: *pragmatism* (the innovation is aimed to achieve commercial success, tracked down in revenues, profit margin, and competitive advantage); *customer orientation* (the innovation needs to be customer-centric and meet customers' both explicit and hidden needs); *openness* (the need to search outside for new ideas, incentives for employees to be receptive to outside ideas, manage external linkages and network-based technology); *holism* (going beyond technology in order to value the new ideas in all areas of the business) and *controlled experimentation* (innovators need early testing of the ideas so that to get feedback and advance more effectively). Besides these elements, the innovation attempts need to be supported by employees, processes and technologies. Cisco white paper also identifies a set of steps to develop innovation: the evaluation of the innovation level within the organization (the main sources for ideas, the number of ideas which were supported, the outcomes obtained following the implementation, the level of understanding customer needs, responsible persons); the identification of the gaps between technology and business (processes that do not foster cooperation and communication, lack of customer orientation, misplacement of resources to projects), and development of a plan which to solve the gap (through implementing organizational changes as required, process optimization, improvement in the technology used). Brown (1998) emphasizes three factors that contribute to the efficiency of new product development: a). the seniority of the manufacturing personnel employed in the company, b). the active participation of the senior managers to the early stages of the development process of a new product, c). development of a manufacturing strategy. All these factors support the strategic value of the new product development for the manufacturing plant.

The interviews conducted by Warren and Susman (2002) on 34 manufacturing SMEs identified the following factors to influence the innovation success: focus on core knowledge and markets with a set goal to cover a certain niche, integration of technology developed internally with the external one, maintaining a close contact with customers, setting a clear research and development strategy, developing a corporate culture open to innovation, integrating customized services with products. On the other hand, the innovation success in SMEs seems not to depend on the industry sector, age of enterprise, firm type (incumbent or entrant) or innovation type (incremental or radical).

3. Research methodology and results

3.1. Research sample and instrument

A quantitative survey based on a questionnaire was applied on Romanian manufacturing companies. The sample included 30 small and medium organizations, out of which 20% of small size (between 1 and 49 employees) and 80% of medium size (between 50 and 250 employees). The majority of the respondents held management positions in the firm (76,6%).

Following the stage based on qualitative interviews conducted with the management of manufacturing companies, based on the data generated and on the research instruments used by other studies, a questionnaire was designed to assess the companies' development needs. The questionnaire measured the need for improvement in different areas in organization. Based on a three points Likert scale (from 3 Very often to 1 Very rare), the respondents assessed the degree or frequency of use of a set of potential improvement methods. The questionnaire assessed the frequency of work organization methods used, the methods used for generating new ideas of development in the working place, the sources used for generating innovations, the perceived competition level with the other organizations, characteristics of the training programs implemented in the company, the communication and team work environment.

3.2. Research results and interpretations

Need for improvement.

The first section of the questionnaire explored the need of improvement in the company with regard a set of functions and areas. The results show that the highest needs of improvement are perceived to be the *development of products and services* and the *cooperation with other companies* (mean 2,44), followed by the *development of information technology and communication*. On the other hand, the lowest need for development is related to the *working schedule* (mean 1,79), *management* (mean 1,95) and *organizational structure* (mean 1,96). While the respondents acknowledge the need for developing the products offered and technology used, they are more reluctant in indentifying difficulties with regard the management activity. It is interesting to find out whether there are differences with regard respondents' perception as a function of their position in the company.

Table 1. Need for improvement in the surveyed manufacturing companies.

Need for improvement in the following area	Mean	Std.dev.
1. Products and services	2,44	,58
2. Information technologies and communication	2,43	,78
3. Technological development	2,29	,69
4. Management	1,95	,69
5. Organizational structure	1,96	,67
6. Work process	2,15	,54
7. Personnel skills	2,32	,62
8. Work conditions	2,26	,60
9. Cooperation within the company	2,36	,70
10. Cooperation with other companies	2,44	,65
11. Payment system	2,04	,75
12. Working schedule	1,79	,58

The independent sample *t* test shows that there are no differences between the two categories of respondents with regard the perceived needs of development, all the *t* test values showing statistically insignificant differences.

3.3. Methods for organization of work

The second part of the questionnaire aimed to assess the usage of a set of methods for work organization. The results show that the mostly used methods are based on *responsibility delegation* (83,3% of the respondent organizations use this method), *multiple functions-multiple competencies* (80% of the respondents), and *consulting the employees* (66,6% of the respondents). The less used methods seem to be independent work groups, functions integrations and job rotation.

Table 2. Usage of methods for organizing the work

Methods used	Yes (%)	No (%)
Job rotation	53,3	46,6
Independent work groups	46,6	53,3
Consulting the employees	66,6	33,3
Quality circles	46,6	53,3
Responsibility delegation	83,3	16,6
Interdisciplinary groups	63,3	36,6
Functions integration	53,3	46,6
Multiple functions – multiple competencies	80,0	20,0

Methods and sources used for generating new ideas for work development

An important component of the survey aimed was to identify the main methods used by companies in order to develop new ideas. The results show that the *internet* is most frequently used for generating new ideas (mean 2,75), followed by *professional journals* (mean 2,29) and *professional training of management* (mean 2,20). Comparing the investment in training for employees and management, the results show that the trainings for management are perceived to be more important. We notice that research results are not so important for the surveyed manufacturing companies.

Table 3. Usage of methods for generating new ideas for work development

Frequency of methods used	Mean	Std.dev.
Professional training of management	2,20	,57
Training of employees	2,15	,54
Seminars and fairs	1,84	,62
Professional journals	2,29	,69
Studies, scientific publications	1,87	,67
Internet	2,75	,44

The next section of the questionnaire aimed to identify the main sources used for generating new ideas. The results show that the clients (mean 2,69) and suppliers (2,48) are considered to be the main sources, being most frequently used. While the focus on customers is of great importance for the innovation process, the results show that universities and research institutes are not valued when aiming to develop new ideas.

The survey also explored the competition in the market as perceived by the respondent companies. The highest competition was perceived with regard the price of the product/service (mean 2,65), followed by the quality of the product (mean 2,37) and development of new products (mean 2,16). The results show that the innovation of competitive organizations is not perceived to be a threat for the surveyed companies.

Table 4. Frequency of sources for generating new ideas for work development

Sources used	Mean	Std.dev.
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Clients	2,69	,47
Suppliers	2,48	,65
Consultants (outside the company)	2,00	,53
Universities	1,47	,79
Vocational schools	1,22	,42
Research institutes	1,16	,48
State authorities	2,04	,62
Employee and employer organizations	2,00	,72

4. Concluding remarks

The survey contributes to the identification of the main development needs, of the methods and sources used by companies for generating innovation. Referring to the elements identified by Barden (2008) to impact on the success of the innovation process, the results show that both *competition* and *market awareness* are not emphasized by the respondents. Still, in accordance with the model developed by Barden (2008) the Romanian companies seem to be stronger focused on training professional management representatives. Also, according to the Cisco innovation model, the Romanian companies seem to be greatly focused on customers, who represent an important component for the innovation success.

With regard the relation between education, research and innovation, the respondents admit not to use sources such as universities or scientific research institutes. Also, the results show that the companies value less the scientific oriented methods for generating new ideas, which might be a cause for the low innovation outcomes in Romania. As future research perspectives, given the small sample surveyed by the present study, the research instrument needs to be applied on a larger, representative sample. Also, there is the need to explore the relationship between the methods and sources used for generating new ideas and the innovation output of the companies.

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